THE BRADYCNEMIDAE, A NEW FAMILY OF OWLS FROM THE UPPER CRETACEOUS OF ROMANIA

by C. J. O. HARRISON *and* C. A. WALKER

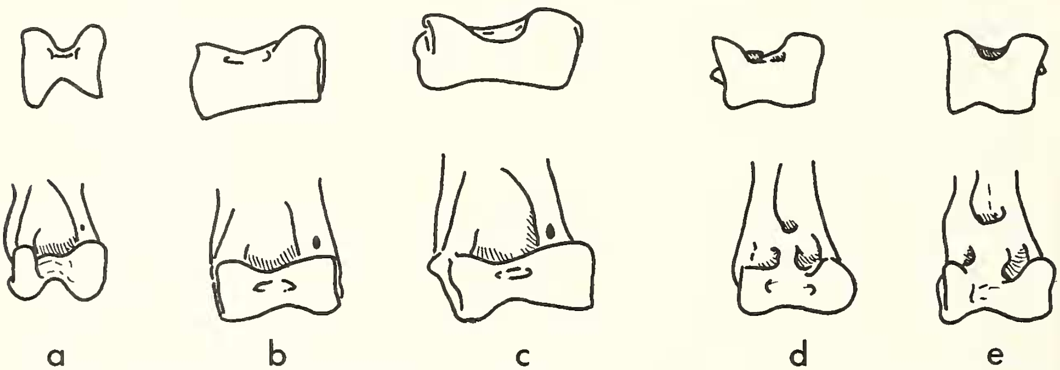
ABSTRACT. The only bird hitherto known from the upper Cretaceous (supposed Maestrichtian) of Transylvania is the pelecaniform *Elopteryx nopscai* Andrews (1913), based on the proximal half of a femur; referred material includes the distal ends of three tibiotarsi from the same beds. Re-examination of these tibiotarsi, however, shows that they belong to the owls (Strigiformes); they represent the oldest owls known and are described and named as two species in new genera, *Bradycneme* and *Heptasteornis*. The posterior side of the condylar region in both genera differs so much from that of the tibiotarsi of Recent owls as to warrant thc separation of these Cretaceous forms into the new family Bradycnemidae.

ANDREWS (1913) described a large bird *Elopteryx nopscai* from the upper Cretaceous of Transylvania, Romania, the holotype being the proximal half of a femur (A 1234). He placed the new genus in the Pelecaniformes, an assignment which is confirmed by our re-examination of the specimen. Andrews also referred to his new species, albeit tentatively, the distal end of a tibiotarsus from the same locality for which he found no parallel among other birds; indeed he may have thought it to belong to the same individual, for he gave it the same register number, though it is now re-registered A 4359—all material is in the British Museum (Natural History). When Lambrecht (1929) discussed bird fossils from this region, and subsequently (1933) included them in his handbook, he referred to this species a further proximal end of a femur (A 1235) and also the distal ends of two more tibiotarsi (A 1528 and A 1588). Of the three distal ends of tibiotarsi A 1588 is wide distally, with a large intercondylar hollow. A 4359, described and figured by Andrews (1913), has condyles of similar diameter but is much narrower. Since it has a median fracture it was first thought that the middle region might have been lost through lateral pressure, but the third specimen, A 1528, which is worn and has some small accretions of hard matrix, does not show similar signs of damage and confirms the general size and shape of the second specimen. Since the differences are not of a kind which could be attributed to sexual dimorphism it would appear that two related forms are involved, one represented by A 1588 and the other by A 4359 and A 1528.

The characters shown by these two forms, however, cannot be reconciled with those of known pelecaniform birds and it is evident that there are no grounds for referring them to the genus *Elopteryx* which is therefore represented only by the femora. A search was therefore made for other avian taxa with which they might show affinities. The broader specimen, A 1588, showed some general similarities to falconiform species and a particular similarity to *Falco rusticolus* (Falconidae) in the shape and position of the condyles and in the development of the external ligamental prominence (text-fig. 1). The Falconidae, however, have a complex tendinal bridge over the tendinal fossa which is absent from the fossils; the resemblance of the

[Palaeontology, Vol. 18, Part 3, 1975, pp. 563–570, pls. 65–66.]

fossils to *Falco* is therefore more likely to be the result of convergence than evidence of affinity. In features such as the absence of a tendinal bridge, the size and shape of the tendinal fossa, the size of the peroneus groove, the proximally placed prominence for muscle attachment on the internal side of the anterior face of the shaft, and the pit just proximal to the anterior face of the internal condyle, these distal ends of tibiotarsi resemble those of owls, Strigiformes; this particular combination of characters is not found in any other order of birds. These fragments appear to represent the earliest known owls; they are earlier than the genera *Eostrix* and *Protostrix*, family Protostigidae (Eocene of North America), and the earliest species of the family Strigidae, a family which is still extant, is from the upper Eocene or Oligocene of France. They differ from Recent owls, however, in lacking any marked posterior projection of the condyles. In modern forms the condyles project posteriorly to a greater distance; the intercondylar groove is deep and extends back to a hollow just proximal to the condyles on the posterior surface of the shaft, exaggerating the degree to which the condyles appear to project. The absence of posteriorly projecting condyles might be either primitive or secondary. The accompanying text-fig. 1 shows the condition in a Recent owl (*a*), in the two fossils (*b*, *c*) and in two Recent falconids (*d*, *e*); the distal views show very clearly that only in (*a*) do the condyles project



TEXT-FIG. 1. Anterior and distal views of right tibiotarsi: *a*, *Strix varia* (Strigidae); *b*, *Heptasteornis andrewsi* gen. et sp. nov. (left tibiotarsus reversed); *c*, *Bradycneme draculae* gen. et sp. nov.; *d*, *Falco rusticolus* (Falconidae); *e*, *Polyborus plancus* (Falconidae). Various magnifications.

posteriorly. The fact that these fossils differ consistently in this respect from Recent owls, more so than the tibiotarsi of the two Recent owl families differ from each other, appears to justify their segregation into a new family; and the structural differences between the two fossil forms suggest that they represent separate genera.

Order STRIGIFORMES

Family BRADYCNEMIDAE nov.

Type genus. *Bradycneme* nov.

Diagnosis. Large owls much larger than any described species. Distal end of tibiotarsus flattened. Condyles not projecting posteriorly; external condyle projecting distally beyond internal condyle; intercondylar groove shallow. Anterior tendinal fossa well defined, broad, fairly deep, its distal margin partly undercutting intercondylar region and external condyle.

BRADYCNEME gen. nov.

Type species. B. draculae sp. nov.

Diagnosis. Distal end of tibiotarsus broad and antero-posteriorly flattened. Distal projection of external condyle beyond internal condyle very marked. Internal and external condyles projecting anteriorly to same extent; projection of internal condyle also directed internally to some extent. Anterior intercondylar fossa transverse, deep. On external side well-developed groove terminating at large external ligamental prominence, proximally situated on external surface of external condyle.

Bradycneme draculae sp. nov.

Plate 65, figs. 1–5

Etymology. The generic name is formed from the Greek *bradys* (= heavy or massive), *cneme* (= leg) and is feminine. The specific name is derived from the Romanian word dracul meaning evil one.

Material. Holotype only. The distal end of a right tibiotarsus, A 1588. Collected and presented by Lady Smith-Woodward, 1923.

Occurrence. Szèntpeterfalva, Hàtszeg, Transylvania, Romania. Beds attributed previously to the Danian (now of the Palaeocene period) but according to Jeletzky (1962) and other modern authors the reptilian forms associated with the deposits indicate a Maestrichtian upper Cretaceous age. The dating problem is now under review by Finnigan.

Description. The specimen is a distal end of a right tibiotarsus with a short portion of shaft. It is in fairly good condition, but damaged in places along the proximal external edge, and with small areas of crushing elsewhere. The proximal part of the shaft shows a ridged and roughened surface. The shaft and head are antero-posteriorly flattened, the shaft being thickest along the internal side. The external condyle projects further distally than does the internal condyle, and is distally tilted towards the internal side. The internal condyle projects internally, its distal edge and the distal edge of the intercondylar groove forming a level transverse surface. Posteriorly the bone is flattened, with smooth curving edges, the central portion of its surface merging smoothly at its distal end with the intercondylar region. Distally and posteriorly the inner edges of the condyles are little in evidence, the intercondylar groove curving smoothly upwards laterally to the outer edges of the condyles. The latter are only slightly prominent posteriorly. Distally the condyles are widely spaced and most prominent at their outer edges, the intercondylar groove being deeper where it borders the external condyle. Anteriorly the condyles have prominent rounded surfaces projecting beyond the line of the anterior surface of the shaft.

On the anterior surface of the intercondylar groove there is the deep transverse groove of the anterior intercondylar fossa; the part of the intercondylar region between this and the tendinal fossa of the shaft forming a narrow lip. The anterior part of the outer surface of the external condyle is hollowed, but there is a large, projecting, external ligamental prominence towards the proximal edge of the condyle. A deep groove extends along the anterior side of the external edge of the shaft, ending abruptly at the external ligamental prominence, at a level with the distal edge of the tendinal fossa. Posterior to this groove a narrow ridge extends along the middle of the internal surface of the shaft. The anterior surface of the shaft is relatively smooth, a large rounded tendinal fossa occupying most of the distal end of the shaft. This fossa is nearer the external side and leaves a thick ridge on the internal side extending to the proximal base of the internal condyle where it bears a small elongated pit. The fossa tapers a little towards the proximal end where it is shallowest and distally deepens to a point just proximal to the condyles. Small areas within the fossa appear to have been crushed, and detail is more satisfactory on the other species, but there is a small rounded hollow at the distal internal corner, slightly undercutting the intercondylar region bordering the internal condyle, and another broader and more shallow just undercutting the internal side of the proximal edge of the external condyle.

The edge of the fossa is rounded on the internal side but a narrow ridge borders it on the external side, slanting externally towards the external ligamental prominence and separating the fossa from the peroneus groove. From comparison with the other specimen it appears that this ridge should form a thick structure, its upper surface slanting internally, just proximal to the external condyle, but on the present specimen crushing has produced a double ridge with a hollow between. There is also a small area of crushing towards the proximal external end of the main narrow ridge. The internal side of the shaft is rounded but much thicker than the external side, and this thickness increases proximally to a point where, on the tibiotarsi of strigiform species, a prominence is present on the anterior internal edge. The shaft of the present specimen appears to have been broken at the point where this prominence occurs.

Measurements. Length from proximal end to distal tip of external condyle 68·7, to internal condyle 60·5. Width across posterior edges of condyles 33·5, across distal ends 35·2, across anterior edges 37·8. Distal/proximal depth of internal condyle 16·9, of external condyle 16·4. Anterior/posterior thickness of internal condyle 20·9, of external condyle 21·0. Length of anterior intercondylar fossa 12·1. Distal end of shaft, internal to external edges 21·7, thickness on internal side 12·6, on external side 8·7, greatest length of tendinal fossa 24·0, greatest width 21·4. Height of external ligamental prominence 4·5 mm.

HEPTASTEORNIS gen. nov.

Type species. *H. andrewsi* sp. nov.

Diagnosis. Distal end of tibiotarsus less broad and less flattened antero-posteriorly than in *Bradycnemis*. Distal projection of external condyle beyond internal condyle very small. Internal condyle projecting much further anteriorly than external condyle. Anterior intercondylar fossa less marked than in *Bradycnemis*.

Heptasteornis andrewsi sp. nov.

Plate 65, figs. 6, 7; Plate 66, figs. 1–7

Etymology. The generic name is formed from the Greek *hepta* (= seven), *asty*- (= town), and *ornis* (= a bird) in reference to the name of the area of origin, and is feminine. It is named after C. W. Andrews.

Diagnosis. The only known species of its genus.

Material. Holotype: distal end of a left tibiotarsus A 4359, presented by Baron von Nopcsa, 1913. Paratype: another distal end of a left tibiotarsus, A 1528. Presented by Baron von Nopcsa, 1922.

Occurrence. Szèntpeterfalva, Hàtszeg, Transylvania, Romania. Maestrichtian (upper Cretaceous). (See comments under previous species.)

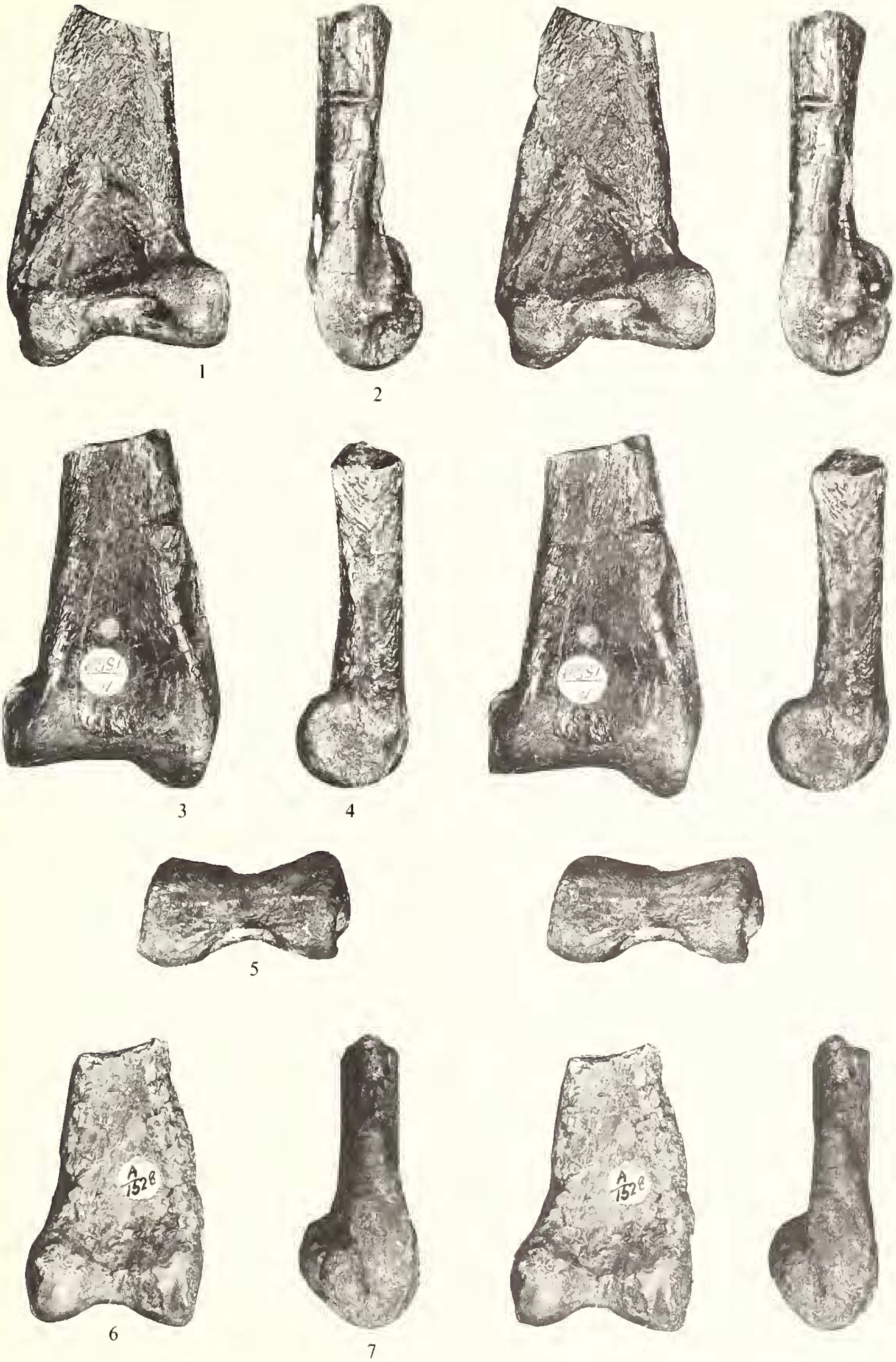
Description. The holotype is a distal end of a left tibiotarsus, broken off before the proximal end of the tendinal fossa. The surfaces are in good condition but the external edge is broken away to the external ligamental prominence, and the specimen had been irregularly fractured along the median axis. The surface

---

EXPLANATION OF PLATE 65

Bradycneme draculae gen. et sp. nov. Holotype: distal end of right tibiotarsus (A 1588). Stereopairs, $\times\frac{5}{6}$. Fig. 1, anterior; Fig. 2, external; Fig. 3, posterior; Fig. 4, internal; Fig. 5, distal.

Heptasteornis andrewsi gen. et sp. nov. Paratype: distal end of left tibiotarsus (A 1528). Stereopairs, $\times\frac{4}{5}$. Fig. 6, anterior; Fig. 7, internal.



HARRISON and WALKER, Cretaceous owls

of the bone shows some very fine ridging and irregular texturing. The posterior surface is flat and smooth, rounded at the edges. The posterior edges of the condyles show only a very slight prominence along the outer edges, and the posterior condylar surfaces continue smoothly from the posterior side over the distal end, with only a shallow intercondylar groove between them. Distally the external condyle projects slightly beyond the internal condyle, but shows the converse condition to that of *Bradycneme* in that the distal surface of the external condyle is shorter and more rounded distally. Anteriorly both condyles are prominent, with a deeper groove between them. The internal condyle projects further anteriorly than does the external condyle, and the anterior ends of both show some internal deflection. The internal side is smooth and flat, slightly rounded at its edges; and the internal side of the condyle shows a hollow towards the anterior edge. On the external side there is some evidence of a projecting ridge which has broken away. There is a portion of a deep, tapering groove. There is a worn area where a ligamental prominence might have been, and a hollow on the anterior side of the outer condylar surface. On the anterior intercondylar fossa, but proximal to it the surface of the groove forms a narrow prominent lip above the distal end of the anterior tendinal fossa which undercuts it. The broad ridge formed by the anterior surface along the internal side of the tendinal fossa terminates at the proximal base of the internal condyle. It bears an elongated pit which appears to have been enlarged by erosion. On the external side of the anterior shaft surface the floor of the tendinal fossa forms a similar ridge with an inward-slanting surface, the floor of the fossa deepening markedly in the central part of the shaft. The distal end of the fossa shows a small rounded hollow in the proximal side of the intercondylar region adjacent to the inner side of the internal condyle, and a similar hollow proximally undercutting the inner side of the external condyle.

The referred second specimen is worn and eroded over much of the surface and elsewhere shows small accretions of matrix which obscure detail. Apart from confirming the general configuration of the holotype it adds little except that, having a longer portion of shaft, it shows the outline of the tendinal fossa, tapering to a point proximally near the external edge of the shaft.

Measurements. Holotype. Length on internal side 30·1, on external side 35·7. Greatest width at distal end 32·5. Distal/proximal depth of internal condyle 13·9, of external condyle 15·7. Anterior/posterior thickness of internal condyle 19·0, of external condyle 17·8, of external side of shaft 11·3, of internal side 12·6 mm.

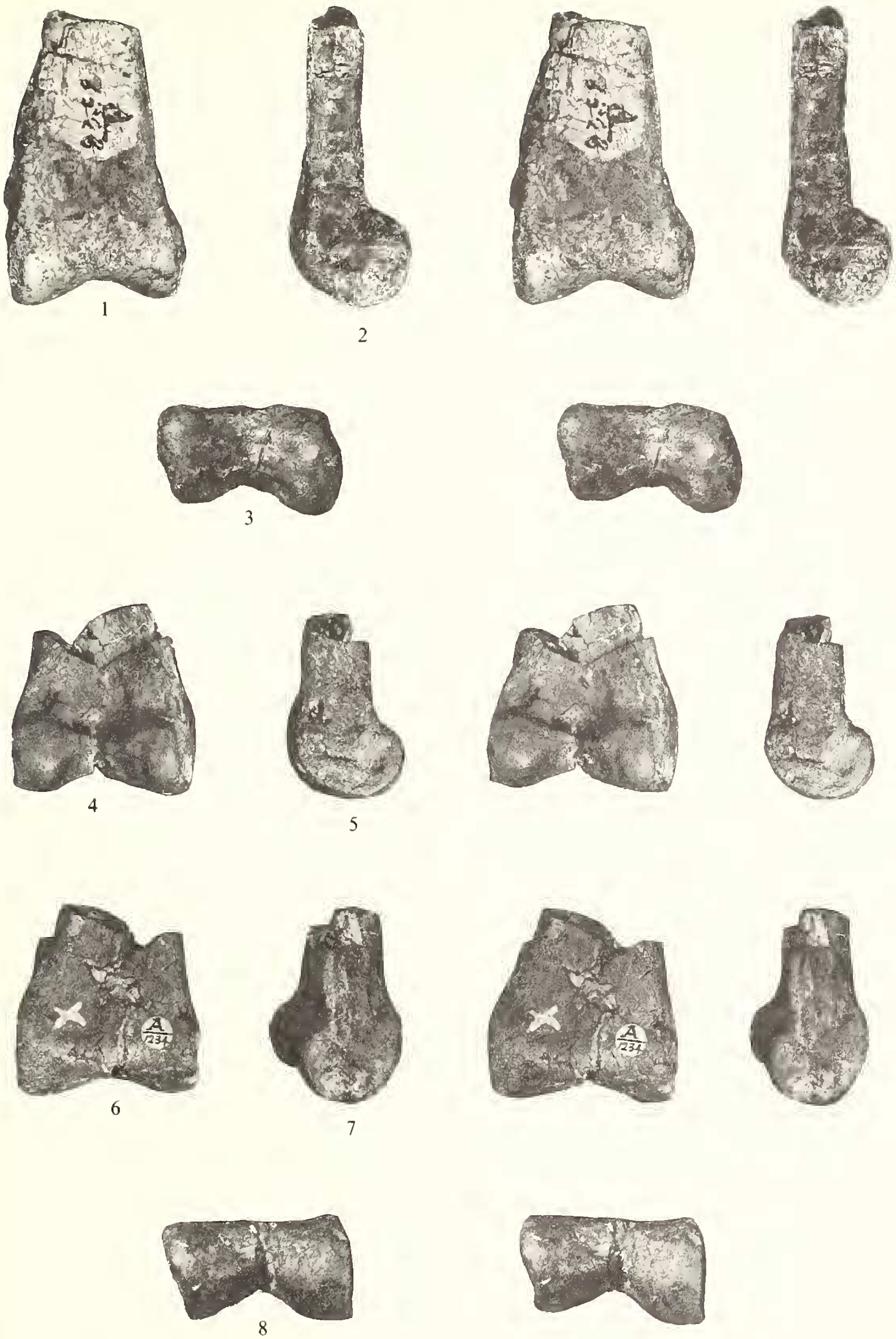
Paratype. Length on internal side 51·0, on external 54·9, greatest width at distal end 33·8, width of proximal end of shaft 17·2. Distal/proximal depth of internal condyle 18·0, of external condyle 16·3. Anterior/posterior thickness of internal condyle 19·7, of external condyle 18·1, of internal side of shaft 11·1, of external side of shaft 10·1. Greatest length of tendinal fossa 27·9 mm.

Discussion. Apart from the flattened condition of the posterior condylar region, the specimens resemble the tibiotarsi of Recent owls such as *Strix*. The existence of giant forms at a period when the other known fauna consists of a huge aquatic bird and a number of large reptiles would not be surprising. In general, in Recent diurnal raptors, the broader, more flattened distal end of the tibiotarsus is associated with species which are relatively sedentary and rely on a rapid flight and swift seizure with the feet to capture their prey, the narrower bone being usually associated with species which walk or run more frequently. The difference in shape of the specimens discussed here might be the result of similar selective pressures.

EXPLANATION OF PLATE 66

Heptasteornis andrewsi gen. et sp. nov. Paratype: distal end of left tibiotarsus (A 1528). Stereopairs, $\times \frac{4}{5}$. Fig. 1, posterior; Fig. 2, external; Fig. 3, distal.

Heptasteornis andrewsi gen. et sp. nov. Holotype: distal end of left tibiotarsus (A 4359). Stereopairs, $\times \frac{5}{6}$. Fig. 4, anterior; Fig. 5, internal; Fig. 6, posterior; Fig. 7, external; Fig. 8, distal.



HARRISON and WALKER, Cretaceous owls

REFERENCES

ANDREWS, C. W. 1913. On some bird remains from the Upper Cretaceous of Transylvania. *Geol. Mag.* (5) **10**, 193–196.

JELETZKY, J. A. 1962. The allegedly Danian dinosaur bearing rocks of the globe and the problem of the Mesozoic–Cenozoic. *J. Palaeont.* **36**, 1005–1018.

LAMBRECHT, K. 1929. Mesozoische und tertiäre Vogelreste aus Siebenbürgen. *C.R. 10th Congr. Int. Zool. Budapest 1927.* Sect. 8, 1262–1275.

—— 1933. *Handbuch der palaeornithologie.* xix+1024 pp., 209 figs. Berlin.

C. J. O. HARRISON

Subdepartment of Ornithology
British Museum (Natural History)
Tring, Herts.

C. A. WALKER

Department of Palaeontology
British Museum (Natural History)
London SW7 5BD

Original typescript submitted 24 April 1974
Revised typescript submitted 20 November 1974